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COLLABORATIVE RESEARCH (USC, HARVARD, USGS): A METHODOLOGY FOR DEFINING CONCEALED EARTHQUAKE SOURCES -- APPLICATION TO THE PUENTE HILLS BLIND-THRUST SYSTEM, LOS ANGELES, CALIFORNIA

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Abstract

We began a multidisciplinary, collaborative effort to define the earthquake potential and late Quaternary expression of the Puente Hills blind-thrust system (PHT) beneath metropolitan Los Angeles. The PHT extends from downtown Los Angeles southeast into northern Orange County, and consists of three distinct geometric segments that may pose significant hazards to the metropolitan region. In 2000, we developed a 3-D model of the PHT and its overlying folds using industry seismic reflection profiles and well control. Structural relief and kink-band widths at the modeled base Quaternary were used to define minimum long-term slip rates of 0.5 to 0.9 mm/yr for these segments.

To assess late Quaternary activity on the system, we acquired a set of high-resolution seismic reflection data in collaboration with USGS researchers Tom Pratt, Rob Williams, Jack Odum, and Bill Stephenson. These profiles image folds above the PHT extending continuously upwards to less than 8 m depth, where well-defined dip panels are on the order of ~20 m wide. These shallow folds support recent activity on the PHT, which reportedly sources the 1987 Whittier Narrows (M 6.0) earthquake (Shaw and Shearer, 1999). Moreover, these folds, which did not grow during the 1987 event, imply that much larger earthquakes have occurred on the PHT that include localized surface deformations. Having demonstrated that recent folding is clearly discernible at borehole/trench depths, and that the active growth triangle extends into the shallow subsurface as a discrete feature, we plan in 2001 to proceed with the excavation phase of this research. Excavations will define the precise geometry of near-surface folding, and provide ^{14}C samples for age control. These data will provide the basis for defining fault slip rates, slip/event, and the ages of past events given the known location, depth, and geometry of the underlying Puente Hills thrust.